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DEVELOPMENT OF A LEADER TRAINING MODEL AND SYSTEM

Edgar L. Shriver, Kermit F. Henriksen, Donald R. Jones, Jr., and Peter W. J. Onoszko

Kinton, Inc.

SIMULATION SYSTEMS TECHNICAL AREA

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The objective of this effort was to develop a preliminary theoretical model specifying the nature and sequencing of training for leaders in an engagement simulation environment. An interaction training model and system (squad through company level) with three distinct learning processes--experiential, analytic, and procedural--was developed. The model addresses identified leader skills and different levels of simulation training. The system further specifies administrative and logistical procedures for conducting training.

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Simulation Systems Training Team

FOREWORD

Research initiated by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) in 1972 has led to the development of a family of tactical engagement simulation training techniques. This report presents a leader training model developed to specify the nature and sequencing of training within the framework of established principles of learning and instruction. The research conducted was in response to the requirements of Army Project 2Q263744A795 as a part of a larger program of research in tactical training for TRADOC.

Joseph Zeidner

JOSEPH ZEIDNER
Technical Director

DEVELOPMENT OF A LEADER TRAINING MODEL AND SYSTEM

BRIEF

Requirement:

To develop a theoretical model specifying the nature and sequencing of training for leaders in an engagement simulation environment.

Procedure:

The leader training model and system was developed so as to specify the nature and sequencing of training within the framework of established principles of learning and instruction.

Findings:

An interaction training model and system (squad through company level) with three distinct learning processes--experiential, analytic, and procedural--was developed. The model addresses identified leader skills and different levels of simulation training. The system further specifies administrative and logistical procedures for conducting training.

Utilization of Findings:

The report provides documentation on one approach to the development of a theoretical model for leader training.

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Development of a Leader Training Model and System

The Dynamic Character of Engagement Simulation (ES)

In this report attention turns to the development of a theoretical model for the training of leaders participating in ES exercises. A distinguishing feature of ES as a viable method of collective combat arms training is the emphasis placed on the combat environment in which the individual as well as the unit must operate. In order to achieve maximum transfer of training, the ES environment must contain as many as possible of the crucial elements that occur in actual combat. However, combat is not easy to simulate. Combat is a highly complex phenomenon for all levels of command, further complicated by a dynamic, uncertain, constantly changing environment where the cues and circumstances to which the unit must respond are infin-itely varied and not likely to be encountered twice in exactly the same way.

Another way of characterizing combat is as an emergent system. There are a countless number of emerging situational conditions that unfold during an operation. Leaders and their forces probe for cues of the enemy, weigh alternative options, coordinate plans, arrange for contingency plans, respond to further cues, make timely decisions, and execute on a collective basis. The appropriateness of these decisions and ensuing actions depends upon how they interact with varying situational conditions of terrain, weather, dispositions, armament, morale, supply, and especially the conditions created by opposition actions. Also as a consequence of the emergent character of two-sided engagements, there can be a number of routes to the system goal (i.e., successful mission accomplishment).

Prior to ES, traditional tactical field exercises did not adequately take into account the complexity and dynamics of the combat environment. Essentially, training took two forms: (a) live fire exercises utilizing immobile targets and (b) the firing of blank rounds between opposing forces with one side programmed, by scenario, to react a certain way regardless of what the first side did. The effectiveness of the performing side was left to the subjective judgment of umpires. The problem with these approaches is poor combat simulation. Immobile targets neither fire back nor take protective cover as would a skilled and determined enemy. While the second approach provides for maneuver, the effects of the maneuvering force on the opponents are prearranged. This means that reliable feedback on the effectiveness of one's actions leaves much to be desired.

Consequently, engagement simulation has been introduced in recent years as a means of overcoming the tactical deficiencies of traditional training. So far, three tactical engagement simulation systems--Squad Combat Operations Exercise, Simulated (SCOPES), REALTRAIN, and Multiple Integrated Laser Engagement System (MILES), have been developed for Army implementation. In SCOPES, a six-powered telescope is easily affixed to each soldier's rifle and a three-inch high, two digit number is printed on all sides of a helmet cover to be worn by all participants. A "kill" occurs when a soldier "scopes-in" his opponent, fires a blank round, and correctly identifies his opponent by number. Casualties are assessed in real time. The record of casualties is kept by means of a control net to which controllers, maneuvering with the respective elements, transmit assessed casualties. Other small arms weapons (e.g., hand grenade, claymore mines) have been simulated in conjunction with procedures for objectively determining casualties. Similar procedures have been worked out for machine guns, the tank main gun, LAW, TOW, DRAGON, and anti-personnel and anti-tank mines. The capability to employ these concepts and procedures for tactical training of combined arms elements is known as REALTRAIN. The use of low-powered, eye-safe lasers to simulate direct fire characteristics (MILES) is the newest of the Army's tactical engagement simulation systems. Individuals and vehicles are girded with laser detection devices which record both kill and suppressive fire beams for accurate and reliable casualty assessment. The MILES program will not only provide greater sophistication with respect to fidelity, but will broaden the range of ES training to full company team and battalion task force levels.

A key procedure of all the tactical ES systems is the After-Action Review. The forces who participated in the exercise are brought together to discuss the major incidents related to successful and unsuccessful outcomes. Feedback in the After-Action Review is not solely directed at individual performance, but more important, focuses on performance of the unit as a collective body. Other desirable features shared in common by the ES systems--already alluded to but which deserve explicit recognition--are (a) the free-play, two-sided engagement which incorporates the crucial elements of complexity and uncertainty, (b) objective and real-time casualty assessment, (c) simulation of modern weapons lethality and weapons signatures, and (d) a heightened level of motivation and interest in training on the part of the participants. This last characteristic of motivation is especially impressive and has been observed on numerous occasions during ES exercises. The following quotation from a report on the initial validation of REALTRAIN with Army combat units in Europe (Root, Epstein, Steinheiser, Hayes, Wood, Sulzen, Burgess, Mirabella, Erwin, and Johnson, 1976) is illustrative.

> The trainees became highly motivated through REALTRAIN practice, as judged by their peers and superiors, and attested to by the participants themselves. Their motivation was enhanced by the realism of the exercise, the spirit of competition, the precise feedback response to hits and kills, and the sense of personal competence that evolved from the learning experience (p. 62).

The initial validation of REALTRAIN, in brief, was quite successful. In addition to high morale among the participants, training effectiveness on a wide variety of measures was consistently positive. Subsequent refinements have been incorporated and further improvements of REALTRAIN are being made on a continuing basis.

The ISD Approach and Its Shortcomings for the Combat Arms

The accepted approach for designing Army training during the past several years has been the Instructional System Development (ISD) model where training objectives are based on job performance rather than "theory" about the job. By means of task analysis, the actions required by the task, the conditions under which the actions are to take place, and the standards or criteria that must be reached, are all specified. Task analysis was developed originally to deal with machine-dominant jobs that can be analyzed down to the level of detail that makes identification of actions, conditions, and standards on a task-by-task basis relatively easy. If task analysis could be applied so successfully to the individual training environment, the Army's Training and Doctrine Command (TRADOC) reasoned that it might also hold promise for complex missions at the unit level. A family of Army Training and Evaluation Programs (ARTEPs) were thus generated which delineated the critical missions for the various types of Army units. In following the ISD model for combat arms ARTEPs, task analysis requires critical missions to be broken down into tasks and performance standards against which the unit's proficiency can be evaluated.

There are several reasons for questioning the adaptability of the ISD model to combat arms training (Shriver, 1976; Root, 1979). In the combat arms, not many of the jobs involve machines which structure the individual's total environment. Instead, tactical operations are a two-sided affair characterized by infinitely changing conditions, many created by opposition action. In such a dynamic free-play environment, further complicated by the confounding conditions of terrain, weather, and countless other variables, is it safe to assume that one can identify in a task analytic fashion all the critical conditions and actions involved in successful mission accomplishment? The ISD model further assumes that the conditions under which the critical processes are carried out will be the same for all occurrences of performance of that task. This assumption is clearly unwarranted in engagement simulation (or combat), conditions during an exercise are never repeated exactly even for two supposedly identical exercises. Also central to the ISD model is the notion that performance standards can be set for each task. This only makes sense if there are repeated occurrences of the same task. While there are some routine tasks where this might be possible in the combat arms (e.g., using proper radio procedure), non-routine tasks such as problem solving will have a different standard for every repetition. The exact same problem with identical conditions is simply not likely to present itself twice. The issue of content validity cannot be ignored either. Using current ARTEPS, if a unit demonstrates its ability to execute each task to specified performance standards, such performance is assumed to yield a valid measure of successful mission accomplishment. The closeness of fit between the task items and actual job behavior is usually the ultimate arbitrator on questions concerning content validity; however, such questions are moot if the preceding asumptions of the ISD model cannot be met in tactical combat operations.

Need for a New Training Model

Some of the shortcomings of traditional and contemporary conceptualizations of training have been noted, especially in terms of their relation to the complex environment of combat arms. Traditional training prior to ES was found to be remiss in not providing a realistic training environment. Soldiers fired at immobile targets that did not fire back or pre-planned attack scenarios were followed with near clock-work precision, the outcomes of which were predetermined. Likewise, the ISD model with its emphasis on task analysis was considered less than adequate for the combat arms. The free-play character of the combat setting is simply incompatible with the ISD assumption that the conditions under which the critical tasks occur are always the same. While these are good reasons for being dissatisfied with traditional combat arms training approaches, there are other compelling reasons which point to the need for a new training model.

Research is now at a stage where it has been possible to identify leader skills and group interactive processes that are likely to play a significant role in the outcome of free-play, two-sided tactical exercises. As far as we know, this has not been done before. Thus, there is a need for a model which addresses ES outcomes as a function of identified leader skills and processes and further helps to specify the nature and sequencing of various training phases. At present, the only model that exists is a fairly general REALTRAIN model (Shriver, Mathers, Griffin, Jones, Word, Root, Hayes, 1975) which essentially describes the engagement simulation process. Leader skills and group interactive processes were not addressed. Another reason for the need of a new or expanded model stems from the curious circumstances that have allowed development to outstrip theory in the refinement of ES as a viable training method. The development of workable ES procedures and ground rules has always been a few steps ahead of the development of ES theory. There is probably implicit agreement as to the basic theoretical tenets "in the heads" of the small community of scientists that are familiar with ES as a training tool. However, a comprehensive model has never been formally stated or put on paper.

The role of a model or theory usually gives direction to further research and helps to make sense out of findings which otherwise would be quite disparate. Furthermore, a more formal model should help us pinpoint leader and group variables that are causally related to unit outcomes. The model would thus provide guidance in allowing us to tie the outcomes of unit action to specific skills and processes (i.e., what specific things did the unit do wrong or omit to cause costly mistakes, and what things did it do correctly that led to success) inherent in the engagement. Once the strengths and weaknesses of the unit's tactical functioning can be identified, specification of unit training objectives logically follows.

Elements of a Leader Training Model

The training model to be proposed identifies three types of learning processes: experiential, analytic, and procedural. There is no precedent as far as we know for this particular combination of learning processes; however, there is a substantial body of research literature that supports each of the individual processes as an effective learning mode. The separate learning processes, in conjunction with some of the relevant research literature, are discussed next.

Experiential. This is the "learning by doing" process. All on-the-job training is experiential, but since no OJT for combat exists in peacetime, the model calls for simulation of as many critical elements of the job as possible. The leader's experiential learning occurs predominantly during engagement simulation exercises, battle simulation games, and in reduced scale exercises. Most noteworthy, individuals are exposed to a simulated battle and are thus given the opportunity to practice the type of leader skills and interaction processes that tactical situations demand.

Engagement simulation should not be confused with gaming simulation although there are similarities between the two. According to Coppard (1976), gaming simulation most likely has its origins in the ancient games of Chess and Go. Both games involve strategic military maneuvers. Application to training situations, however, did not begin until the early 1880s, when the Prussian Army used games consisting of large, detailed maps together with color-coded wood blocks to represent troops (Coppard, 1976). Players planned troop movements and use of appropriate armaments. Following the game, player actions were discussed and critiqued. Since then, gaming has become very popular. Enthusiasm had spread by the 1960s from military gaming to applications in business (Graham and Gray, 1969), education (Carlson, 1969), political science (Coplin, 1967), and government (Abt, 1970). Raser's (1969) Simulation in Society: An exploration of Scientific Gaming provides a number of other intriguing examples of research done with gaming simulations.

Coppard (1976) traces the popularity of gaming simulation today to a number of trends. In recent years, complex problem areas have benefited from the utilization of system analysis and computer science. Gaming simulation has readily made itself amenable to new technology. Trends in education have also changed over the years. Alternative approaches to teaching have emerged where emphasis is placed on group processes, problem-solving approaches, cognitive skills, and participative peer learning. Classrooms have become more open; field-gestalt learning principles are embraced by educators. Gaming simulation is quite congruent with these trends. Furthermore, the influence of Herbert Simon starting in the late 1940s on the study of decision-making processes has certainly been supportive of gaming. Games are especially useful in focusing attention on the decision-making process and thus provide a convenient laboratory for studying decision-related issues.

Practitioners of gaming simulation are quick to point to the advantages(Coppard, 1976). Among those most frequently cited, which also can be cited for engagement simulation, are the following:

- An elevated level of motivation among participants is the most frequent observation of gaming simulation training. The high level of motivation generated by the experience is thought to result from both the immediate feedback and the competitive nature of the games.

- Gaming simulations provide an ideal opportunity for transfer of training. Skills are learned in a context highly similar to that in which they will be ultimately used. (Battle simulation and engagement simulation provide ample opportunities for problem-problem-solving, communication, interacting with subordinates and superiors--the exercise of which occurs in real combat.)

- Gaming simulations provide a risk-free environment for making important decisions and executing a course of action. (The fact that one's mistakes are immune from irreversible adverse consequences is considered as a disadvantage by some critics of simulation but this is an argument that would call for abandonment of all training.)

- Gaming simulations provide a low cost method for systematically exploring the intricate relationships and interconnections among the elements in a system in a way not possible with other methods. The purpose of the debriefing after the simulated exercise is usually to isolate cause-and-effect relationships having a direct bearing on the outcome of the exercise.

- Because of the free-play character of many gaming simulations, participants are likely to confront any of a wide variety of constantly changing situational demands. Pre-planned strategies have to be drastically overhauled in the face of unforeseen events, stress, and time constraints. Players are forced to make contingency arrangements--a skill often overlooked by traditional training methods.

While these are cogent reasons which recommend the use of gaming simulation, the reader should be aware that the claims of aficionados are often exaggerated. Coppard has noted that gaming simulation is still more of an art than a science and very little evaluative research has been done on why it is as effective as it seems to be. In spite of this, there have been attempts to develop procedures from which gaming simulation exercises might be designed. It may be premature to develop a set of procedures for all the likely uses to which gaming simulation can be applied. More important in terms of research and development is the use of gaming simulation as a structure for gathering data and testing theory in a realistic environment. In brief, gaming experience is the primary vehicle for ascertaining what skills and processes play significant roles in a free play situation and it is primarily the same type of experience that provides an environment for subsequent skill development.

Analytic. Analytic learning occurs in the leader training model primarily after the exercise has been conducted. This is a cognitive-verbal process through which experiential events are analyzed and explained. The purpose of the analytic phase is to reconstruct the action which occurred in a tactical exercise in as much detail as possible in order to emphasize lessons learned during that exercise. Somehow amidst all the complexity and sometimes confusion that is possible with a dynamic, free-play engagement, attention needs to be drawn to the salient features of the experience. Unless significant events are identified and magnified, they might remain obscure among all the other happenings of the exercise and valuable lessons to be learned could be lost. Thus, an analytic process allows significant events stand out; experience alone is not sufficient. Not only does the analytic process reaffirm what was learned during the engagement, but it also identifies omissions or what was not learned in the exercise. If the platoon leader, for example, does not make clear to his subordinates what contingency plans they are to follow in the event he is assessed a casualty, the analytic process will uncover this omission. Another reason why the analytic learning is so important stems from the well-known realization that not everyone experiences the same thing during an exercise. When significant events of the exercise are reconstructed, participants learn from the account of others' experiences. The group analytic process is a way of getting the most out of the exercise for the greatest number of participants. It also allows individuals to learn how their actions contributed to unit outcomes. Individuals begin to understand the role they play in the overall context of the operation. Furthermore, the analytic process is essential because it allows training analysis to proceed from individual diagnosis and assessment of leader deficiencies to a unit diagnosis, and finally, to the development of training objectives. It is the analytic process where an understanding of the unit's strengths, weaknesses, and areas in need of improvement are identified.

Procedural. Learning how to perform any task that can be reduced to following a set of procedures falls under the rubric of guided or procedural learning. Tasks that can be reduced to following a set of procedures are quite amenable to self-directed or individualized methods of instruction. In any training situation, there is bound to be a wide variety of individual skill differences. Any model purporting to address the training of leader skills must eventually recognize and attempt to deal with the different skill acquisition levels among participants. For example, one leader might be able to conduct an effective terrain analysis with respect to the positioning of weapons while another leader might be seriously lacking in this skill. For a long time, individual differences were ignored in training and educational programs. It is only recently that attempts have been made to correct this oversight and a variety of methods and systems of individualization have been designed. In the last few years, a number of these attempts have occurred in higher education (Goldschmid and Goldschmid, 1973). An examination of some of the more frequently used methods of individualized instruction is in order.

Modular instruction, first to be considered, is now a widely-practiced approach in educational settings, particularly learning centers. A module is a self-contained unit of a planned series of learning activities for helping students accomplish certain well-defined objectives. It may include a variety of materials such as textbook units, articles, viewing films and slides, listening to audio-tapes, and participating in demonstrations. Most noteworthy, modular instruction offers a choice among a large number of topics within a given study program and is thus adaptable to individual skill levels. It also allows the student to engage in specific remedial work (weak areas are identified and the student does not have to restudy large amounts of subject matter) and provides immediate feedback of student performance by means of self tests. Because modules are self-contained units and cover limited discrete content they can be easily revised and modified in the formative stages of development.

The Personalized System of Instruction (PSI), employed in numerous universities and colleges, is an alternative to traditional lecture-dominated instruction (Keller, 1968). Under PSI, the course of study is broken down into units. In a typical semester, there may be 14 units which parallel the 14 chapters from the course text. Study guides are prepared for each unit; included are introductions to the material, unit-objectives, recommended strategies for reaching the objectives, and sample questions. The objectives, best written in behavioral terms, describe the terminal behaviors the student should display upon completion of the unit. Students work individually on the unit, usually in class, and are required to demonstrate their mastery of the material before moving on to the next unit. The mastery requirement is an important concept and helps to mitigate against what can be called cumulative failure--the increasing difficulty of learning material in the course because the learning of previous related material was never mastered. Mastery is defined as perfect or near perfect performance on the unit examination. Another distinguishing feature is self-pacing, which allows students to proceed through units at their own pace while keeping mastery of the material nearly constant. Exams are taken, or re-taken if failed the first time, whenever the student feels prepared. Formal lectures and demonstrations are used for motivational purposes, rather than as sources of critical information. Class time is spent reading and working on unit requirements. The instructor's role changes to that of course manager; he or she prepares and organizes all study materials and examinations, and is responsible for evaluation of student progress. Course grades are usually based on number of points accumulated or units completed. The use of students as proctors has always been an untapped resource in higher education, but is an integral part of the PSI system. Student proctors may be advanced students recognized for superior previous performance in the course during an earlier semester or they may be currently enrolled in the course but ahead of their peers in terms of unit completion. They are involved in repeated testing, immediate scoring, one-to-one tutoring, and they enhance appreciably the personal-social aspect of the learning process.

The initial testing ground for PSI was carried out in the behavioral and physical sciences. As enthusiasm for the new method grew, so did the number of disciplines willing to try PSI. Today, the literature on PSI has expanded to such an extent that it is difficult to find an academic discipline that has not utilized PSI.

Another individualized approach in the educational literature is Individually Prescribed Instruction (IPI). As the name implies, the core of IPI is an individual prescription of instructional activities by which the student's work is guided (Glaser, 1968). Curricular materials are often of a programmed nature. Successful application of IPI according to Glaser (1968) may be found in grade schools, high schools, and universities (e.g., Bucknell University, University of

Texas, Kansas State University, and the United States Naval Academy). Particularly important in IPI is the careful determination of the student's present competence in a given subject and frequent evaluation in order to correct weaknesses and prescribe appropriate instructional activities.

It should be noted there is considerable overlap among the various individualized methods of instruction. Certain common features that we feel are desirable will be incorporated in the training system. These features are student-centered learning, promotion of active student participation, encouragement of self-pacing, modularized units, and frequent feedback and evaluation.

Other reasons for a procedural process of learning deserve mentioning. Of special note, the procedural process highlights the skill and insures that it will be addressed with the desired level of intensity. The experiential portion of the training model cannot guarantee this since there is no assurance that the same situation calling for the same skill will confront the same individual in an ES exercise. If the skill can be acquired in a procedural fashion, there is no need to incur the cost of a full-scale engagement. There may be other skills--those that require an engagement context for optimal development--that the procedural process can only partially enhance.

Learning Principles and Benefits that the Training Model Incorporates

Earlier we stated there was no precedent for the proposed model and its particular combination of learning processes. It was pointed out, however, that each of the learning processes taken separately embodies a well-established domain of psychological and instructional principles. Table 1 summarizes some of the most prominent learning principles and benefits, coupled with their corresponding theoretical learning processes.

Experiential. The first learning principle listed in Table 1 is response-contingent reinforcement. There are many opportunities in an ES exercise for a soldier to receive immediate reinforcement for the responses he emits. For example, the well-concealed individual who scopes-in and scores a hit on the unsuspecting soldier is receiving immediate feedback on his actions. Skinner (1938) is credited with initiating laboratory experimentation on response-contingent reinforcement and is equally well known for applying operant conditioning principles to practical settings. The Skinnerian dictum that "behavior is shaped by its consequences" is just as true in ES as it is in any other free-operant situation. As in combat, the consequences of one's actions in ES are not always pleasant. The soldier who raises his head to take a peek at the enemy when under suppressive fire is likely to be assessed a casualty. In operant terminology, this is known as response-contingent punishment since one's actions lead immediately to aversive consequences. An extremely important lesson that is often overlooked is that ES has the capability of teaching participants what not to do as well as what should be done.

TABLE 1

ELEMENTS OF THE TRAINING MODEL AND CORRESPONDING LEARNING PRINCIPLES

LEARNING PROCESSES	LEARNING PRINCIPLES AND BENEFITS
Experiential	Response-contingent reinforcement Response-contingent punishment Intrinsic motivation Learning by discovery Positive transfer of training Overlearning Latent learning Problem solving
Analytic	Focused feedback Peer learning Vicarious learning Understanding of assigned roles Understanding of overall gestalt (Interrelated actions of individuals and groups that have a direct bearing on unit outcomes) Verbal enunciation and transfer Diagnosis of individual and unit training needs
Procedural	Individualized acquisition of skills Self-selection of skill modules Self-paced mastery Frequent feedback Active participation Manageable modular units Two-way exchange of information with consultants

Individuals who have either informally observed or objectively investigated engagement simulation as a training system (e.g., Root et al., 1976) usually comment on the increased level of motivation among the participants. The realism of the exercise, the competitive edge that is whetted, and the recognizable gains in individual competence combine to make this type of training intrinsically motivating. The nice thing about intrinsically motivated behavior is that it provides its own rewards; one does not need to furnish external incentives "to get the job done." In fact, in his research on intrinsic motivation, Deci (1975) has found a performance decrement in those subjects who were externally rewarded for behavior they normally performed voluntarily. The use of an extrinsic reward system for ES thus appears unnecessary and perhaps even deleterious.

Leaders learn during an engagement primarily by discovery. Discovery learning is often pitted against expository learning: is it better to let the student make errors and discover the solution by himself or to explain to him how to solve the problem? This has been an active controversy in the psychology of instruction for some time and bears all the hallmarks of being a pseudo-issue (Shulman and Keislar, 1966). One thing is clear. Research will not demonstrate that one method is unequivocally better than the other. Any comparison of instructional methods must specify the criteria for accomplishment, since different criteria often yield different conclusions. More important is the question of what criteria relate most to the investigator's concerns. Is one interested in time to solution, number of errors, transfer to other problems, or criticality of mistakes? Should one be interested in the by-products of the training method such as the level of motivation created? In terms of the problem solving demands placed on the combat leader and the need to maintain active interest in training among peacetime personnel, there is no better alternative in our judgment to learning by discovery.

Another desirable feature of the engagement simulation setting is the positive transfer of training that it provides participants. Positive transfer of training refers to situations where previous training facilitates performance on a subsequent task. Both the stimuli that participants respond to during an engagement and the responses that they make are highly similar to those that would occur in actual combat. Experimental research on transfer of training shows that the variables of stimulus and response similarity are directly related to positive transfer: (a) where stimuli are varied and the responses kept identical, positive transfer increases with increasing stimulus similarity, and (b) where stimuli are kept identical in the initial and transfer tasks and response similarity varies, positive transfer will increase with increasing response similarity (Ellis, 1965). It should be remembered that these transfer principles were obtained under well-controlled laboratory studies on paired-associate learning. In such studies the stimuli and responses are usually nonsense syllables, common words, or simple geometric shapes. A degree of caution is thus best exercised in applying these principles to environments as complex as ES. Nonetheless, Ellis (1972) maintains that there are certain guidelines one can follow in order to maximize the occurrence of positive transfer. His practical pointers are: (a) practice under varied task or stimulus conditions,

(b) arrange learning so as to begin with easier features of the task before moving on to more complex features, (c) make sure that sufficient practice with the initial task is obtained before expecting much transfer, and (d) train under conditions that at least approximate those of the ultimate testing conditions. It is encouraging to note that the compatibility between Ellis' suggestions for positive transfer and the basic features of the training model is quite good.

In an experiential setting there is ample opportunity for overlearning. In the experimental literature, overlearning refers to the continuation of learning trials beyond the criterion for mastery. For example, if it takes a subject 16 trials to learn a list of serial material to a criterion of one perfect recitation, requiring the subject to recite the list eight more times would constitute a 50% overlearning procedure. The usual effect of the overlearning procedure is that it enhances long-term retention (Underwood, 1954). More related to an ES situation is the overlearning of psychomotor skills. Fortunately, recurring tasks that require motor skills are most always overlearned--they are performed excessively beyond some criterion of mastery (i.e., observe an adult who rides a bicycle with little difficulty after a 20-year absence). The ES environment provides the opportunity to overlearn a number of motor skills (e.g., assembling a M16A1, setting a pace, driving an APC) required in any combat setting.

The experiential setting also allows a certain amount of latent learning to manifest itself. Blodgett's (1929) classical study on latent learning demonstrated that performance based solely on contiguous stimulus-response (S-R) associations (e.g., rats running a multiple T-maze with no explicit reward) could be suddenly improved with the introduction of food in the goal box as a reward. The interpretation given to the sudden improvement is that the rats had already learned the maze prior to reward on the basis of contiguous S-R associations but that the reward was necessary for the learning to be manifested in performance. On the basis of ES experience, it is our impression that there are quite a few skills learned in the Army combat schools that lie dormant for some time since there is no urgent incentive to exercise them. Engagement simulation contains the motivating properties to make manifest combat skills that have been acquired and that have remained latent in other settings. In short, individuals will not hesitate performing previously acquired skills if the training exercise is challenging, realistic, and meaningful.

The last experiential learning benefit in Table 1 is problem solving. As stated before, the small arms combat leader is basically a problem solver, and in any given ES exercise there will be no shortage of problems with which to cope. It would be nice if there was a magic formula for teaching people how to solve problems. But there is not. At present, the teaching of problem solving is much like prescientific farming. Some do better at it than others, and everyone has an opinion. General strategies of problem solving which tell us to seek information, allow for incubation, formulate tentative hypotheses, and verify hypotheses are as good as any. The determination of optimal procedures for solving a specific problem requires knowledge of the critical factors inherent in the situation. Since problem solving is a complex system of interacting processes, it seems reasonable that the system holds alternative paths to the solution. Remaining flexible to deviations from prescribed procedures, and practicing solutions to closely-related problems are two hints that keep reappearing in the problem solving literature (Johnson, 1972). The free-play character of ES exercises is amenable to both suggestions.

Analytic. During the analytic phase of the training model, experiential data are assembled, some of the data are discarded while other data are highlighted for emphasis. The learning benefit of focused feedback as it appears in Table 1 refers to the gains to be made by bringing into sharper focus significant events and skills that were in evidence (or not in evidence) during the exercise. Experience alone as feedback is not sufficient; focused feedback helps to magnify and reaffirm amidst all the other happenings of an ES exercise what is important and what is not.

Both peer and vicarious learning are integral aspects of the analytic process as well. MacKenzie, Evans, and Jones (1970) have noted that peer learning is one of the most frequent untapped resources in higher education today. We suspect that there is a lot of unrecognized learning brought about through peer interactions in current combat arms training. Often it occurs on the spur of the moment or in a haphazard fashion. The analytic process is one way of providing greater structure so that participants of the exercise can learn from the accounts of others' experiences. Peer learning as it occurs in the assembly area after an exercise helps compensate for the fact that not everyone experiences the same thing during an exercise. Closely related to peer learning is vicarious or observational learning. It has long been recognized that humans do not have to engage in a given activity to actually learn that activity. Bandura (1969, 1971) has systematically investigated the conditions under which vicarious learning occurs; many of them are present in an ES context (i.e., the task has to be meaningful or relate to the welfare of the individual, the model should be an authority figure or be respected for his or her competence, and the contingent relationship of rewards and punishments to the model's behavior should be unambiguous).

Understanding one's role in any professional organization is certainly an important determinant of job satisfaction (Lawler III, 1973). A source of irritation for individuals at the squad leader level is that they are requested to perform maneuvers without having a clear understanding of how their activities fit into the overall mission. As the analytic process starts to fill in the missing bits and pieces of what actively happened during the exercise, participants start to understand not only their assigned role but also the role of others. A somewhat higher and rarer form of understanding occurs when individuals acquire an understanding of how the interrelated actions of individuals and groups mesh in such a way as to have a bearing on unit outcomes. For lack of a better expression, we refer to this as understanding of the overall gestalt.

A time-honored cliche from the academic world holds that "if you want to learn something, teach it". This old saw can be rephrased as the hypothesis that learning is more efficient when the learner puts the relevant information into words for communication to others. We refer to this as verbal enunciation and transfer in Table 1. Johnson (1972) notes that it is not the actual enunciation of the principle that is important, for a principle can be vacuously memorized and repeated verbatim, but it is the generalization of the principle by the learner on the basis of his experience with certain problems that is supposed to facilitate application to other problems.

And finally, the last benefit listed in Table 1 that results from the analytic process is more of a training rather than learning benefit. All of the foregoing analysis and feedback makes it easier to proceed from individual diagnosis and assessment of leader deficiencies to a composite picture of unit performance from which the leader develops training objectives.

Procedural. The instructional benefits of procedural learning when conducted in a self-paced format have been commented upon earlier but deserve summarizing here. As Table 1 indicates, our proposed use of procedural learning individualizes the acquisition of skills. The pri-mary adantage of individualizing training is that it takes into account the individual differences that are bound to exist among students (Goldschmid and Goldschmid, 1973). Participants are more likely to make up areas of deficiency and avoid other areas already well learned through a self-selection of skill modules. The learning modules themselves are self-paced with built-in checks for mastery. This precludes the hit or miss quality of traditional instruction that Keller's (1968) PSI approach so successfully challenges. Feedback is frequent, thus informing participants of their continued progress while insuring active participation. Furthermore, modular units are small in size, thus presenting the material to be learned in manageable form (Johnson and Ruskin, 1977). The ensuing benefit is that participants experience a great sense of accomplishment and confidence. The role of consultants or peers in the procedural process is that they provide for a two-way exchange of information, often times beneficial to both consultant and student.

Relationship between Leader Skills and Model

Table 2 shows the relationship between the learning processes of the model and the expected levels of gain or yield for development of the leader skills identified earlier. It should be noted that the various levels of gain represent the research staff's best guess based upon its experience and research completed to date. The reader may come up with slightly different relationships between the skills and learning processes. We suggest that all relationships be regarded as tentative hypotheses awaiting empirical support. For the present, the rationale upon which Table 2 is based warrants discussion.

Examination of Table 2 shows that planning as a leader skill is likely to be most effectively developed through experiential and analytic learning processes. It is through experience and analysis of that experience that the leader discovers what level of detail is required if plans are to be implemented adequately during an exercise. As leaders work together in successive iterations, less detail of certain kinds (and more of other kinds) is needed. It is only through successive iterations of ES exercises that leaders can experience this shift and be sensitive to differences in level of planning detail required. It is difficult to see how a procedural process (i.e., following a set of precribed planning procedures) could accomplish such awareness.

The same reasoning holds for execution and control. As we have defined it, execution and control refers to the extent to which leaders are able to implement and carry out field operations to their successful conclusion. Since this skill is so dependent upon field exercises, it is reasonable to expect that the experiential mode will offer the greatest yield for its development. The type of analysis that occurs after the exercise is considered moderately helpful while a procedural approach would be considered least useful.

The next skill in Table 2 refers to the extent to which leaders structure their roles and those of their subordinates toward goal attainment. This is another skill that we feel requires successive interations and analyses of ES exercises before the leader develops an appreciation for how much structure is needed. As subordinates become more proficient in their assignments and as a sense of coordinated team work develops, the leader can turn his attention to more tactically-oriented concerns. To reach this level of coordinated proficiency, however, requires plenty of practice, and this can be best achieved via the experiential mode.

Interacting with subordinates and superiors in a way that promotes mutual trust, respect, high morale, and group cohesiveness is the last management skill listed in Table 2. There is certainly a meaningful context for interacting with subordinates and superiors during an ES or BS exercise. Also these same skills are treated in various leadership

TABLE 2

RELATIONSHIP BETWEEN LEADER SKILLS AND LEARNING PROCESSES OF THE MODEL

LEADER SKILLS*	EXPERIENTIAL	ANALYTIC	PROCEDURAL
Management			
Planning	H	H	L
Execution and Control	H	M	L
Initiating Structure	H	H	L
Interaction w/Sub and Superiors	H	L	M
Communication			
Transfer of Information	H	H	M
Pursuit and Receipt of Information	H	H	M
Problem Solving			
Identifying and Integrating Cues	H	H	L
Weighing Alternatives	H	H	L
Chooses and Executes Course of Action	H	M	L
Tactical			
Application	H	H	M
Technical			
Basic	H	L	H
Equipment	M	L	H

H - High Gain M - Medium Gain L - Low Gain

*These skills originate from an earlier report concerned with identification of combat unit leader skills (Henriksen, Jones, Hannaman, Wiley, Shriver, Hamill, and Sulzen, 1980).

courses that most Army officers and NCOs attend. Therefore, interaction skills, we feel, can be acquired quite readily through experience and fairly well through procedural means. Analysis (i.e., self-reflection) of how one interacts with others may play a certain role, but is more difficult to train.

For the communication skills of transfer of information and pursuit and receipt of information, the engagement situation once again provides a meaningful context. Although not many leaders would argue about the criticality of these skills, the ES and BS context makes communicative demands on leaders simultaneously with the performance of other duties. Leaders do not calmly perform these tasks during an engagement. They often fail to do what should be done--most likely because they have learned it out of context in a different setting. The experiential setting is required if leaders are to acquire the habit of transferring and pursuing information amidst all the other distractions and demands of combat. Just as important, we feel, is the analytic learning process. Analysis, when conducted properly, should trace the outcome back to critical events and many of the critical events in past ES exercises have been failures of communication. Procedural learning also has a role to play here. The familiar Army acronym SALUTE refers to six items of information (size, activity, location, unit, time, equipment) to be transmitted in any situation. This mnemonic device, which is learned usually through the procedural mode in combat arms schools, informs leaders of the type of information to be transmitted. Procedural learning thus can benefit the leader by letting him know what to transmit when the appropriate time comes.

For the problem solving skills, Table 2 shows that experiential learning is considered a high gain process. Early in the research effort the point of view was developed that the combat arms leader is foremost a problem solver. The free-play, dynamic character of engagement and battle simulation provides an ideal opportunity for leaders to try out their problem solving skills and to experience first-hand the consequences of their decisions. And it is through successive iterations of the experience that problem solving skills develop. Problem solving differs from ordinary learning in that it requires a solution previously not within the individual's repertoire of responses. Old knowledge and experience have to be drawn upon and rearranged to form new hierarchies of solutions. Unlike pre-planned scenarios, there is no singular, correct way of conducting the exercise in engagement simulation. This stems from the infinitely variable conditions that can and do arise. Therefore, the learning experience that can best challenge an individual's problem solving prowess is the experiential process.

The experiential process is certainly necessary, but it may not be sufficient if the full benefit of the engagement is to be realized. An analytic phase is also needed. In the analytic process, leaders construct a case history (i.e., their own case) of the engagement by means of controller, opposition, and friendly force information. It is natural that every leader develops his own perception of "what happened" from the information he collects during the experiential phase. The analytic process is intended to provide a more objective and fuller account of the exercise in that participants work backward from final outcome to events that led to the outcome. The analytic process is diagnostic with respect to practically all skills and when the inadequacies of all other skills are partialled out, what remains are decisions and problem solving processes that preceded those decisions. The feedback stemming from the analysis when focused on critical events allows the leader to re-examine his decisions and hypothesize what he would have done differently if all the information gained during the analysis were available to him. New hypotheses are likely to occur, subject to test in ensuing exercises. Procedural instruction is considered a low gain approach for the development of problem solving skills. A possible exception would be the use of case histories of the sort used by professional and graduate schools (e.g., Harvard Business School) which, in effect, are abstractions or simulations of real problems. Case histories are usually studied in a group setting and our conception of procedural learning centers on the use of self-contained modules which do not for the most part involve the presence of others.

Application of tactical principles appears next in Table 2. Every leader is told when he receives instruction in tactical principles that he must adapt them to the combat situation. Both ES and BS represent such situations in simulated form. Leaders are ultimately responsible for application of tactical principles. What is learned in combat arms schools and various FMs is applied to the experiential setting as it develops. Successful application of tactics interacts with and depends, in part, upon effective performance of all the other skills. This means the results of tactical decisions are not as likely to be clearly perceived on the basis of experience alone. Extensive analysis is once again required. With continued analytic practice, leaders will be better equipped to analyze the situation they have just experienced so as to separate out the effects of various skills and identify the effects of tactical skill separately from the others. Obviously, this ability to isolate causal relations is not gained in one application. Proficiency in tactical skills requires an abundance of both experiential and analytic learning. The two processes are intricately intertwined; experiential learning will not be as effective without the sharpening focus that the analytic process provides and analytic learning would be a vapid exercise without a realistic environment in which unit outcomes can be tied to leader and group skills. The role of procedural learning for the development of tactical skills is not very extensive. By the time most officers and NCOs enter the training system, they will have acquired knowledge of tactical principles at a level consistent with their rank and responsibilities. We are concerned primarily with the application of these principles as evidenced by the high gain ratings for both the experiential and analytic processes.

Table 2 lists two categories of technical skills: basic and equipment. The table also shows that basic skills (e.g., terrain analysis and map reading) are most likely to develop from experiential and procedural learning. For the experiential process, certainly the environment or context in which the skills of terrain analysis and map reading are to be performed is very important. Engagement simulation and battle simulation (to a lesser degree) provide the contextual cues on which these skills depend. These skills are initially taught in a somewhat procedural fashion by the combat arms schools. We concur that there are certain basic principles of map reading and terrain analysis that are best taught in a classroom setting, and therefore the procedural mode is acknowledged as well. Equipment skills tend to be machine dominant, and in such systems, operators follow well-established procedures to reach the system goal. Procedural learning is thus a high gain process for equipment skills. A certain degree of experience in operating the equipment is needed (provided by Army schools), and further experience in a tactical environment is desirable for gaining an appreciation of the equipment's performance limits. Thus, we consider the experiential mode a moderate gain process. Analysis does not play a large role in developing proficiency on technical skills and as a result is considered a low gain process in the table.

Integrating Elements of the Model into a Training System

Up to this point, discussion of the model's learning processes--experiential, analytic, and procedural--has been on a theoretical plane. It is now appropriate to examine how these elements can be incorporated into an actual training system. There are certain preparatory skills that leaders have acquired in various Army schools. Also, many leaders have been exposed to previous field exercises, and in some cases to combat. The training system makes no assumptions regarding the degree of preparatory skill each participant has when he enters the system. Vast individual differences can be expectd with respect to entry skills. In order to accommodate these individual differences, the training system to be described is inherently flexible.

The unit commander or training manager to some extent will be aware of these individual differences, however, in order to gain a better understanding of the strengths and weaknesses of personnel, the first training exercise to be developed should be relatively simple. There is no need to develop a full-scale combined arms exercise until some basic tactical maneuvers can be performed adequately (i.e., an infantry platoon conducting an attack on a defended position).

Depending on the resources available and the cycle of unit training, the entry point for leaders into the training system will be some form of simulation: engagement simulation (ES), reduced scale (i.e., reduced scale ES), and battle simulation (BS). Battle simulation can be used either before or after a company goes into its field training program. When used before field training, battle simulation gives leaders needed practice on various planning, problem solving, and tactical skills. Leaders must make detailed fire plans, anticipate enemy actions, and employ direct and indirect fire effectively. Inexperienced platoon leaders especially may appreciate the opportunity to acquire new tactical insights without the presence of their troops. On the other hand, other players may not realize the value of battle simulation until they have experienced an ES exercise. Uncommitted BS players are likely to afford the BS games greater respect once they realize on the basis of their ES experience that there are numerous skills that can be acquired in BS.

The training manager, depending upon the experience of participating leaders and also upon what other resources are available to him, can decide to enter the training system with either ES or BS execises. Figure 1 shows that the point of entry should be through one of the experiential modes rather than through the analytic or procedural mode. There is some evidence to support the idea that analytic and procedural learning are more effective after a need has been demonstrated in a simulated context. In a study on M1 rifle training at night (Jones and Odom, 1954), the training objective was to give soldiers the psychomotor "feel" of how much to lower their front rifle sights when firing at night. Research analysis had determined that at night soldiers tend to "sight" with the front sight while depressing the rear sight so as not to obscure their limited vision of the front sight. The effect was a tendency to fire high at night. But explaining this to the soldiers did not improve their performance at night. They did not learn from analysis alone. The next learning process to be tried was to provide them practice in the daytime, after giving them the analytic solution. Again, their performance scores did not improve at night. Finally, soldiers were taken to the firing range at night, told to fire at silhouette targets, and shown how their rounds went high. This was an experiential learning situation. Then they were given the analytic explanation and the daytime firing opportunity. With use of these three separate learning processes the soldiers' performance improved when firing at night. The soldiers first had to experience the problem and get feedback in context. It was reasoned that this experience was necessary to motivate them to correct the error and to provide a context for the verbal analytic explanation of the error.

A similar point of view--sometimes called a functional context approach--is taken here. The approach puts individual skills into a larger context at a very early stage in the training process (Shoemaker, 1967). For example, when following this approach, maintenance training starts with maintenance activities such as troubleshooting and adjusting the equipment. This approach has several advantages over the traditional training and applies equally well to the combat arms. It motivates students to do well since they can see the results of their actions in a real-world context and it assures that they will get beyond "baby steps" since they will be practicing skills at an early stage. When students practice skills in context they can see easily what additional information they need to do the job. Once this need has been identified through experience, the students become more interested in learning more basic skills so that they will do well the next time they practice in context.

The most appropriate functional context for the combat arms is a combat environment. During an ES exercise, leaders are assigned respective missions and are then responsible for making plans, issuing orders, responding to cues of the enemy, transferring information, and ensuring that subordinates properly execute orders. As a result of the free-play character of the exercise, leaders are trained to confront a wide variety of continuously changing situational demands. There are plenty of opportunities for decision-making, choosing a course of action, and experiencing the consequences.

Completion of the exercise usually coincides with a well-recognized unit outcome. This ushers in the analytic process of learning (Figure 1). The After-Action Review (AAR) is the principal technique for facilitating analytic learning. The AAR is a systematic effort to reconstruct in as much detail as possible, significant events that occurred during the exercise. Its origins can be traced back to Marshall (1956) and the 1943 campaign in the Gilbert Islands. Marshall used the reconstruction technique in order to analyze and write historical accounts of various major battles. Hackworth (1967) saw the value of this technique as a means to improve and enhance the performance of troops in combat. Word (1976) recognized the value of the AAR in engagement simulation (ES) situations and prescribed specific procedures for its conduct in ES. Since the initial development of ES, research has consistently demonstrated the value of the AAR techniques (Root, et al., 1976; Bosley, Onoszko, and Sevilla, 1978).

The AAR after an ES exercise usually begins with a brief description of each leader's plan. Next, with the aid of a net control sheet (i.e., a record of events including each player casualty, time of casualty, and weapons employed), the review leader covers the events in chronological order and encourages the respective participants to more fully describe their intentions and actions. Participants learn what their actions looked like to the opposition force (e.g., "One of your platoons came up the route of advance I expected you to take, but they held up before moving into the kill zone I set up. I held my units...waiting for your men to move and then your main force came in behind me. I guess I forgot all about protecting the rear"). The skillful review leader will be careful

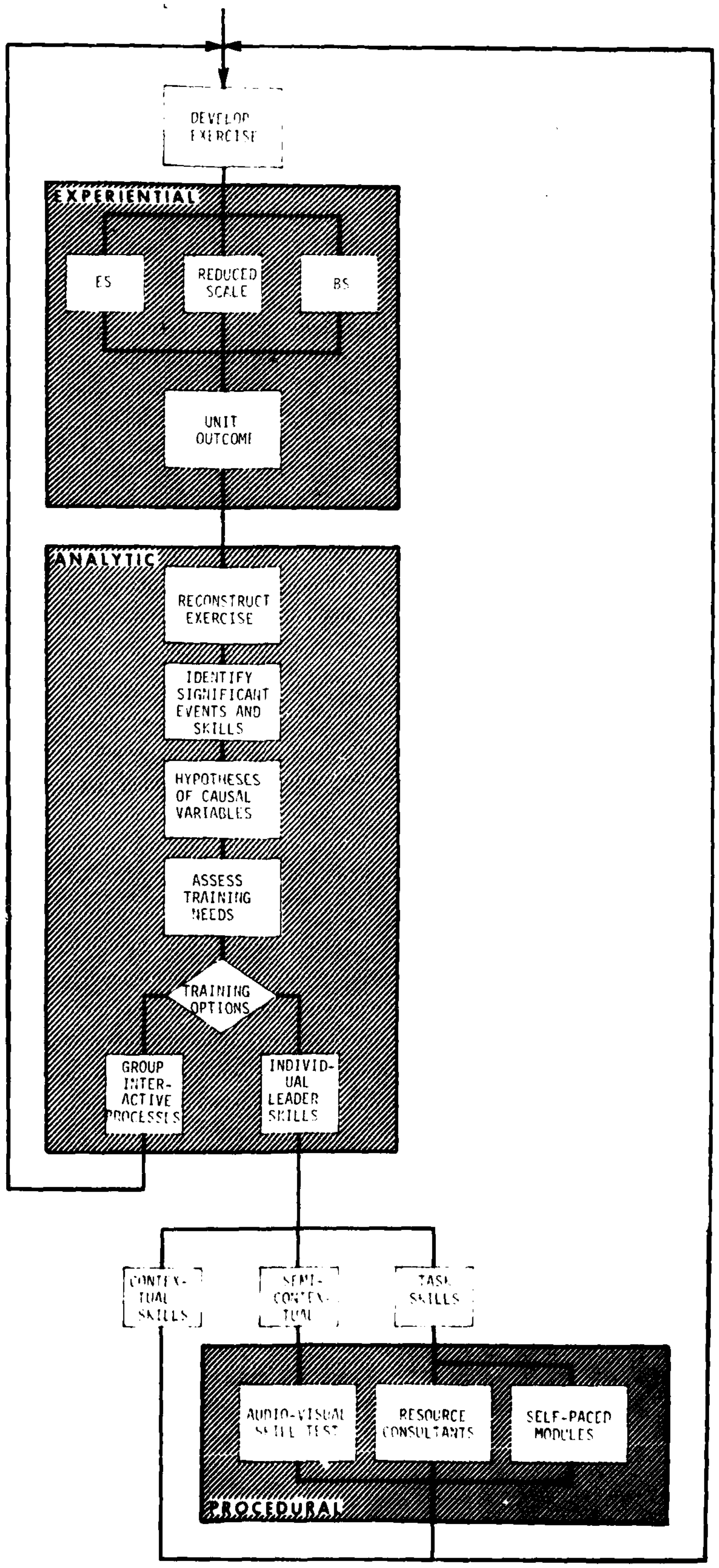

FIGURE 1 LEADER TRAINING MODEL FOR ENGAGEMENT SIMULATION

not to let the AAR lapse into a critique of individual performance or into a vapid listing of "who shot who". When conducted in an informative fashion, significant events and skills will be highlighted. Reasonable hypotheses can then be constructed which relate the experiences and actions of participants to unit outcomes. It is at this point--after achieving a full understanding of the events that led to the engagement outcome, that the unit commander and his staff assess training needs. Figure 1 shows two broad options that are likely to confront the training staff: a) further group training in a simulated context where the emphasis remains on dynamic, two-sided interactive group processes, and b) individual leader skill training where leaders can correct deficiencies on an individual basis. A considerable range of training possibilities exists with the first option. Group training may consist of small teams such as a fire team or tank crew carrying out a well prescribed function, a platoon may be assigned further training in order to maneuver more effectively, or an expanded full-scale combined arms execise may aspire to more advanced training objectives. Another possibility is for leaders to resort to battle simulation, especially if they wish to try out tactical strategies in the formative stages of development. For the training of individual leader skills, Figure 1 indicates that some of these skills can be regarded as contextual in that their acquisition most likely requires a full experiential setting (e.g., the communicative skill of pursuit and receipt of information). Other skills can be regarded as semi-contextual (e.g., identify enemy's probable location) and can be taught through a lower form of simulation such as the audio-visual skill test. Yet other skills are more task-oriented and can be acquired independent of an ES or BS context (e.g., learning to use correct radio procedures).

Performing semi-contextual and task skills involves a procedural learning process. These are skills that can be practiced usually on an individual basis by following a set of self-contained procedures. Procedural learning can be provided in the form of self-paced written or audio-visual modules, or in the form of resource personnel. The self-paced modules and resource personnel will comprise a Skill Development Resource Pool (SDRP) to which individual unit leaders can be directed to improve their proficiency on specific tasks. It is observed that the Army has already modularized a great deal of instruction on procedures through its TEC program, Soldiers' Manuals and Skill Qualification Tests. The next step is to add modules for those leader combat skills not present in the Army's current repertoire of modules. It is also recognized that existing modules may need to be modified (i.e., reduced size and changes in content) to make them suitable to use in conjunction with ES exercises.

The use of resource personnel deserves further comment as well. Research personnel who have conducted previous ES exercises have been the recipients of many requests from ES participants on how to comply with certain tactical and technical procedures. Such guidance was usually given on the spur of the moment to small groups of leaders or on an individual basis. This type of guidance was always appreciated, but for a long time it was taken for granted. It is now realized that helpful guidance is a form of instruction. Resource consultants are utilized most frequently after the AAR--skill deficiencies have just been discovered and motivation for improvement is high.

Skills that are semi-contextual in nature (i.e., those that depend in part upon an experiential setting) can be acquired in the SDRP by means of the newly-developed audio-visual skill test described in a report on earlier phases of the research program (Henriksen, et al., 1979). In brief, the audio-visual skill test presents leaders with problem solving demands similar to those found in ES or combat. On the basis of historical data obtained in an ES exercise, leaders are shown an enlarged topographical map on a screen and are provided with specific information about their mission and the enemy situation. A series of slides and accompanying audio cues (radio transmissions) describe a progressive increase in engagement intensity with an enemy force. Leaders are asked to assess the situation and indicate on answer sheets probable enemy deployment by specific type of element or weapons system. A time limit for completing the task is placed on leaders so as to simulate the time constraint and pressure a leader experiences in an actual exercise.

Although the audio-visual skill test was initially developed as a diagnostic tool to assess a leader's ability to exercise problem solving skills, its potential as a training technique for skills that require an engagement context is indeed promising. Several tactical experiences can be incorporated within a single module. This would provide a leader, in a short period of time, with several tactical experiences. The opportunity for a leader to practice and focus on one skill area, without having to address the complexities of an ES exercise, provides in-depth coverage and helps to maximize the learning of that particular skill. The audio-visual modules can be presented to individuals stationed at learning consoles or to groups in a seminar or classroom setting. After the initial presentation, the modules can be replayed to provide a detailed analysis of the depicted action. A replay can also be used to promote discussions of the problem, if the modules are taken in a group setting. Additional modules for other skill areas such as planning, execution and control, and communication can also be developed and incorporated into the SDRP.

It is important to note that the training model in Figure 1 is an iterative one; each level builds upon the experiences and feedback provided by the situations that went before. The iteration works as follows. Units A and B come to the engagement situation with sets of skills X and Y. All units, whether put together for the purpose of the training exercise or having been together for years, come with some set of skills. Skill sets X and Y are bound to be different in some respects and probably have some elements in common. The two units engage each other. During the engagement certain things are learned or partially learned by every participant. Having been at different locations and experienced different conditions in those locations, the skills learned by each participant will be different. Each participant also perceives his own part of the unit goals and tries to accomplish those goals.

The participants next come to an After-Action Review. Here they learn more about the conditions they experienced during the engagement. They learn what their actions looked like to the opposition. The experiential learning of the engagement and the verbal learning in the AAR are brought together. Ideally, everyone learns something and everyone can see deficiencies in his own skills. Personnel perceive different skill needs--depending on their own experiences and what goals they have set for themselves and their unit. They are motivated to draw information from the SDRP at this point. A leader may want to reread his field manual on how to produce surprise or how to conduct a demonstration to confuse the opposition leaders. Another may want to learn to call indirect fire because he was next to the forward observer (FO) when the FO became a casualty and he did not know how to call indirect fire. The skills that are drawn from the SDRP are specific sets of information. They are the skills that enable personnel to perform specific tasks better in the next ES exercise.

When the next iteration of the ES situation is scheduled (shortly after the first) units A and B come to the situation with a new set of skills X' and Y'. They have learned from experience, from the verbal feedback, and from the SDRP. The engagement that ensues between them will involve different conditions for each side because of the new sets of skills each has acquired. Each side will go through all the same processes they did on the first iteration but with the opportunity to learn new content, set new goals, and perceive new needs. Following this iteration, the two units A and B will acquire two new sets of skills X'' and Y''. With this experience, feedback from the AAR, and new information from the SDRP as required, each side will be prepared for another iteration. This again will repeat the processes of the original exercise, but again new conditions based on new capabilities on each side will produce new learning experiences.

This driving of the conditions up to more and more complex levels is an essential aspect of the training model. It is noted that the training model does not produce identical sets of skills in both units. However, each will acquire a level of proficiency beyond that achieved by conventional training methods because as one side progressively develops, a more sophisticated challenge confronts the other side.

Summary. The purpose of this final segment of the overall research effort was to develop a theoretical model and training system for leaders (from fire team leader through company commander) participating in ES exercises. It was asserted that prior to ES, tra-

ditional tactical training did not adequately take into account the complexity and dynamics of the combat environment. The ISD model also was found to be remiss in that it would require one to identify in a task analytic fashion all the critical conditions and actions involved in a successful combat/ES mission. Since conditions during an exercise are never the same even for two supposedly identical exercises, the ISD model with its emphasis on task analysis was considered inappropriate. With the development of workable ES procedures, there existed a need for a theoretical model which addresses the type of training to effectively and efficiently enhance leader skills and group interaction processes.

The model proposed here identifies three types of theoretical learning processes: experiential, analytic, and procedural. Each of the learning processes embodies a well-established domain of psychological and instructional principles. The experiential process is essentially "learning by doing" and is manifested in the training system in simulated form (i.e., ES, BS, and reduced scale exercises). Analytic learning is a group process whereby significant experiential events are reconstructed so that participants can learn how their actions contributed to unit outcomes. The analytic process is formalized in the training system by means of an After-Action Review (AAR). The AAR is a way of getting the most out of the exercise for the greatest number of participants. Participants become aware of their skill deficiencies as a consequence. The procedural process refers to task-oriented learning that can be reduced to following a set of self-contained procedures. For this type of training, individuals are referred to a Skill Development Resource Pool (SDRP) where they can consult self-paced modules or resource personnel for the purpose of enhancing skills that need improvement. Those skills, such as problem solving, that require in part the contextual cues of an ES environment, are regarded as semi-contextual. A prototype audio-visual module, incorporating the salient cues found in an ES exercise, was developed to present leaders with a realistic tactical problem (locating enemy forces on a topographical map). Other skills which depend on group interactive processes are acquired in a fuller simulated setting (ES, BS, or reduced scale).

The model also provides guidance in delineating the relationship between the learning processes and expected levels of gain or yield for development of earlier identified leader skills.

The iterative nature of the model is of special significance; it presents a method for progressively increasing the skills of each unit. As one unit improves, increasingly complex conditions are created that upgrade the skills of the other side in coping with them.

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